भारतीय मानक
Indian Standard

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कृषि वस्त्रादि — लैमिनेटेड बुने हुए फलोद्यान संरक्षण आवरण — विशिष्टि

Agro Textiles — Laminated Woven Orchard Protection Covers — Specification

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Technical Textiles for Agro-tech Sectional Committee, TXD 35

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Technical Textiles for Agro-tech Sectional Committee had been approved by the Textiles Division Council.

Orchard protection covers are useful in protection of orchards/fruits from hailstorm and heavy rainfalls. Laminated woven orchard protection covers are nowadays widely used by farmers for fruits like berries, grapes, cherries etc to improve the productivity and quality of the orchards.

These helps in maintaining the optical conditions by diffusing light during summer and delays fruit ripening and maintains warm conditions during winter season due to Infra-Red (IR) thermicity to induce early ripening/harvesting of orchards. These effectively retards the growth of pests by blocking (Ultra-Violet) UV radiations coming from the sun.

Protection covers are loosely placed and bear lot of stresses during heavy hailstorms, which is sustained effectively by providing laminated reinforcement band at edges, eyeleting and tying with flexible ropes. Woven type orchard protection covers have better tear and puncture resistance and are suitable for the intended purpose. In order to exert the heat accumulation which may result in non-sprouting, the covering needs to be moved, which can be done effectively without any damage to woven covers. Covers may also needed to be removed during rainy season to leach out salts from soil. Woven covers are suitable to withstand the stresses during movement of the covers.

The guidelines for installation, storage and handling of laminated woven orchard protection covers are given in Annex F for information only.

The composition of the Committee responsible for the formulation of this standard is given in Annex G.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AGRO TEXTILES — LAMINATED WOVEN ORCHARD PROTECTION COVERS — SPECIFICATION

1 SCOPE

This standard prescribes constructional and other performance requirements for laminated woven orchard protection covers manufactured from high density polyethylene (HDPE) tapes to improve the productivity and quality of orchards.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 16366 and following shall apply.

3.1 Diffused Radiation — Solar radiation received from the sun after its direction has been changed by reflection and scattering by the covering material.

3.2 Elasticity — The tendency of a material to return to its natural size and shape after removal of deforming load.

3.3 Reinforcement — A strong material added to a base material to improve its strength, stiffness, and impact resistance.

3.4 UV Stabilizers — UV stabilizers are used frequently in plastics, including cosmetics and films. The primary function is to protect the substance from the long-term UV degradation effects from ultraviolet radiation. Different UV stabilizers are utilized depending upon the substrate, intended functional life, and sensitivity to UV degradation.

4 MATERIALS

4.1 HDPE Tapes

Tapes shall be manufactured from HDPE granules (*see* IS 6192) which shall be UV stabilized by a suitable UV stabilizer. The width of the tape used in the fabric shall be minimum 2.5 mm and linear density of the tape shall be 1 000 Denier (111.1 tex). As agreed to between the buyer and the seller, coloured tapes shall be manufactured using colour master batch. The denier of HDPE tape shall be subjected to the following tolerances:

a) ±10 percent on individual value; and
b) ± 5 percent on average.

4.1.1 The heat shrinkage of the tape at 60 °C shall not exceed 5 percent when subjected to the specified temperature for a period of 10 min in an air circulating oven. The heat shrinkage of the tape at 95 °C shall not exceed 8 percent when subjected to the specified temperature for a period of 10 min in hot water bath.

4.2 Fabric

The fabric used in the manufacture of laminated woven orchard protection covers shall be woven in circular loom and shall have a width as agreed to between the buyer and the seller. The HDPE woven fabric shall have a minimum of 40 tapes/dm in both warp and weft directions. A selvedge of 450 ± 5 mm, having double warp tapes shall be provided at both ends of the fabric.

4.3 The colour or a mixture of colour of the fabric shall be as per the agreement between the buyer and the seller. The colour/shade shall be as specified in the contract or order. In case a sample has been agreed upon and sealed, the supply shall be made in conformity with the sample in such respects.

5 TYPES

Based on the thickness and mass, in g/m^2 and type of reinforcement at edges of woven fabric, the material shall be classified as follows:

a) *Type 1* — Having thickness of 0.14 mm and mass of 140 g/m^2 without laminated reinforcement band at the edges;
b) *Type 2* — Having thickness of 0.14 mm and mass of 140 g/m^2 with laminated reinforcement band at the edges. Minimum width of the reinforcement bands shall be 10 cm;
c) *Type 3* — Having thickness of 0.16 mm and mass of 160 g/m^2 without laminated reinforcement band at the edges; and
d) *Type 4* — Having thickness of 0.16 mm and mass of 160 g/m^2 with laminated reinforcement band at the edges. Minimum width of the reinforcement bands shall be 10 cm.

6 MANUFACTURE

6.1 Lamination

6.1.1 The HDPE woven fabric shall be laminated on both sides with low density polyethylene film (LDPE) or with suitable combination of LDPE and linear low density polyethylene (LLDPE). The coating thickness shall be minimum 25 micron on each side or as agreed to between the buyer and the seller. The coating lamination thickness shall be measured at a pressure of 2 ± 0.01 kPa by method A of IS 13162 (Part 3). The coating film shall be UV stabilized by adding a suitable UV stabilizer.

6.1.2 For band lamination, two layers of HDPE fabric shall be bonded together by sandwich lamination. For sandwich lamination, the coating thickness shall be minimum 50 micron or as agreed to between the buyer and the seller. The sandwich lamination thickness shall be measured at a pressure of 2 ± 0.01 kPa by Method A of IS 13162 (Part 3).

NOTE — Lamination is very important and critical requirement for the product and its proper process control shall be ensured during manufacturing.

6.2 Joints/Seams

If two or more pieces of HDPE woven fabric are used, they shall be joined together by a suitable heat sealing process keeping an overlap of minimum 25 mm.

6.3 Eyelets

The number and position of metal eyelets made from aluminium or steel shall be as agreed to between the buyer and the seller. The eyelets shall be provided with the reinforcement pieces. The outer edge of the eyelet shall be as close as possible to the edges of the laminated woven orchard protection covers. Eyelets shall have a minimum of 16 mm internal diameter and maximum distance between two eyelets in longitudinal direction shall be 50 cm or as agreed to between the buyer and the seller.

6.4 Rope for Tying the Laminated Woven Orchard Protection Cover

Three stranded twisted polypropylene rope of 6 mm diameter, conforming to IS 5175 shall be provided for tying the laminated woven orchard protection cover with the support frame. The length and colour of the rope shall be as agreed between buyer and the seller.

7 REQUIREMENTS

7.1 Workmanship and Finish

The laminated woven orchard protection covers shall be uniform in colour, texture and finish. It shall be free from pin holes, undispersed raw material, particles of foreign matter, etc, and the laminated film shall not peel off from the fabric.

7.2 The laminated woven orchard protection covers shall also conform to the requirements given in Table 1.

8 PACKING AND MARKING

8.1 Packing

The laminated woven orchard protection covers shall be packed in roll form in length as agreed to between the buyer and the seller. The rolls shall be packed with HDPE fabric laminated on both sides with low density polyethylene (LDPE) or of the same construction and specifications as that of the rolls.

NOTE — The laminated woven orchard protection covers may also be packed with air bubble film.

8.2 Marking

The laminated woven orchard protection cover roll shall be marked legibly with the following information:

a) Name of the manufacturer or trade mark;
b) Type of laminated woven orchard protection cover;
d) Mass per square meter of the laminated woven orchard protection cover;
e) Batch number or Lot number; and
f) Any other information as required by the buyer or the law in force.

8.3 BIS Certification Marking

The laminated woven orchard protection cover rolls conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the laminated woven orchard protection cover rolls may be marked with the Standard Mark.

9 SAMPLING

9.1 Lot

All laminated woven orchard protection cover rolls of same construction and type dispatched to a buyer against one dispatch note shall constitute a lot.

9.2 Unless otherwise agreed to between the buyer and the seller, the number of laminated woven orchard protection cover rolls to be selected at random from a lot shall be as given in column 3 of Table 2.

10 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

Number of test specimens and criteria for conformity shall be as given in Table 3.

Table 1 Requirement for Laminated Woven Orchard Protection Covers

(*Clause* 7.2)

Sl No.	Characteristic(s)	Requirement(s)				Method of Test, Ref to
		Type 1	*Type 2*	*Type 3*	*Type 4*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Thickness, mm, *Min*	0.14	0.14	0.16	0.16	IS 7016 (Part 1)
ii)	Mass, g/m^2, *Min*	140	140 with band	160	160 with band	IS 7016 (Part 1)
iii)	Average breaking strength of laminated woven orchard protection cover fabric (Strip method, 325 mm × 50 mm test piece with gauge length of 200 mm), N, *Min*					IS 1969 (Part 1)
	a) Warpway	680	680	780	780	
	b) Weftway	680	680	780	780	
iv)	Retention of breaking strength after UV exposure of 1000 h, percentage of original actual value (fabric), percent, *Min*	80	80	80	80	Annex B and IS 1969 (Part 1)
v)	Strain at maximum load, percent	← 15 to 25 →				IS 1969 (Part 1)
vi)	Impact failure load at 1524 mm drop, *Min*, gram force at 50 percent failure	1150	1150	1150	1150	Annex C
vii)	Reinforcement band strength, N, *Min*	1370	1760	1560	1960	IS 1969 (Part 1)
viii)	Ash content, percent, *Max*	1	1	1	1	Annex D
ix)	Total visible light transmission, percent	85 ± 5	85 ± 5	85 ± 5	85 ± 5	IS 13360 (Part 9/Sec 5)
x)	Light diffusion, percent (*see* Note 2)	50 ± 5	50 ± 5	50 ± 5	50 ± 5	IS 13360 (Part 9/Sec 5)
xi)	Thermicity IR effectiveness, percent (*see* Note 2)	45 ± 5	45 ± 5	45 ± 5	45 ± 5	Annex E

NOTES

1 The laminated woven orchard protection cover may also be provided with anti-dust, anti-mist, anti-fog, and anti-sulphur properties as agreed to between the buyer and the seller.

2 Depending upon the crop, climate and location etc, other values for light diffusion and thermicity IR effectiveness may be specified as per agreement between the buyer and the seller.

Table 2 Scale of Sampling

(*Clause* 9.2)

Sl No.	No. of Rolls in Lot	Sample Size	Sub-Sample Size	Permissible No. of Defective Rolls
(1)	(2)	(3)	(4)	(5)
i)	Up to 50	3	2	0
ii)	51-150	5	2	0
iii)	151-300	8	3	1
iv)	301-500	13	5	2
v)	501 and above	20	5	3

Table 3 Number of Test Specimens and Criteria for Conformity

(*Clause* 10)

Sl No.	Characteristic	No. of Rolls/Bundles	Criteria for Conformity
(1)	(2)	(3)	(4)
i)	Material, manufacture, mass and workmanship and finish	According to column 3 of Table 2	The defective rolls do not exceed the corresponding number given in column 5 of Table 2
ii)	All other requirements	According to column 4 of Table 2	All the test specimens shall pass the tests

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
105-B02 : 2014	Textiles — Tests for colour fastness: Part B02 Colour fastness to artificial light : Xenon arc fading lamp test
1969 (Part 1) : 2018	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
5175 : 2014	Fibre ropes — Polypropylene split film, monofilament and multifilament (PP2) and polypropylene high- tenacity multifilament (PP3) – 3-, 4-, 8- and 12-strand ropes (*third revision*)
6192 : 1994	Textiles — Monoaxially oriented high density polyethylene tapes — Specification (*second revision*)
7016 (Part 1) : 1982	Methods of test for coated and treated fabrics: Part 1 Determination of roll characteristics (*first revision*)
13162 (Part 3) : 2021	Geosynthetics — Determination of thickness at specified pressures: Part 3 Single layers (*first revision*)
13360 (Part 9/Sec 5) : 1999	Plastics — Methods of testing: Part 9 Optical properties, Section 5 Determination of haze and luminous transmittance of transparent plastics
16366 : 2015	Glossary of terms used in agrotextile

ANNEX B

[*Table* 1, *Sl No.* (iv)]

DETEMINATION OF RESISTANCE TO THE EXPOSURE OF ULTRAVIOLET LIGHT (XENON-ARC TYPE APPARATUS)

B-1 PRINCIPLE

Specimens of laminated woven orchard protection covers are exposed for 1 000 h of ultraviolet exposure in a Xenon-arc apparatus. The exposure consists of 120 min cycles consisting of 102 min of light only, followed by 18 min of water spray and light. After the exposure, the specimens are subjected to breaking strength test as prescribed in IS 1969 (Part 1). The test results are compared to the test results for unexposed specimens and the deterioration which has taken place due to ultraviolet exposure is assessed.

B-2 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

Condition the test specimens to moisture equilibrium from the dry side in the standard atmosphere of 65 ± 2 percent relative humidity and 27 ± 2 °C temperature. When the specimens have been left in such an atmosphere so that both the faces are exposed to the standard atmosphere as far as possible for 24 h, they shall be deemed to have reached the state of moisture equilibrium.

B-3 PREPARATION OF TEST SPECIMENS

B-3.1 Cut 5 test specimens each for testing breaking strength [*see* IS 1969 (Part 1)].

B-3.2 Specimens shall not contain dirt, irregular spots, creases, holes or other visible faults.

B-4 APPARATUS

B-4.1 The working details of Xenon-arc apparatus are described in IS/ISO 105-B02.

B-4.1.1 The apparatus shall be capable of exposing the specimens to cycles of light only, followed by water spray and light under controlled atmospheric conditions.

B-5 PROCEDURE

B-5.1 Operate the Xenon-arc apparatus as directed in IS/ISO 105-B02 to provide 120 min cycles as follows:

> 102 min of light only at 65 ± 5 °C black panel temperature, and 30 ± 5 percent relative humidity, followed by 18 min of light and water spray.

B-5.1.1 Set the minimum level of radiation to 0.5 W/m^2, 1 nm bandpass at 340 nm.

B-5.2 Now expose five specimens for testing breaking strength, for 1 000 h exposure time. Place test specimens in the apparatus such that the side most likely to be exposed to the effects of ultraviolet light will be exposed in the apparatus.

B-5.3 At the end of exposure time, remove the test specimens for testing breaking strength, as per the method prescribed in IS 1969 (Part 1).

B-5.4 Test five unexposed specimens (zero exposure time) and five exposed specimens for breaking strength, as per the method prescribed in IS 1969 (Part 1).

B-6 CALCULATIONS

B-6.1 Calculate the average breaking strength, for all exposed and unexposed specimens.

B-6.2 Calculate the percent loss of breaking strength, for the exposed specimens from the average results.

ANNEX C

[*Table* 1, *Sl No.* (vi)]

DETERMINATION OF IMPACT RESISTANCE

C-1 TERMINOLOGY

C-1.1 Impact Failure Load — The load at which 50 percent of the specimens fail when tested by this method.

C-2 ANNULAR SPECIMEN CLAMP

C-2.1 Two Piece Annular Specimen Clamp — Having an inside diameter of 12.7 cm and conforming to the following requirements:

a) The lower or stationary half of the clamp shall be rigidly mounted so that the plan of the specimen is horizontal and at an angle of 90° with respect to the upright shaft-supporting member of the apparatus.
b) The upper or movable portion of the clamp shall be designed to maintain positive and planer contact with the lower portion of the clamp when in position. This portion of the clamp shall be provided with suitable means for maintaining sufficient contact with the lower clamp to hold the specimens firmly in place during the test.
c) Gasketing materials prepared from rubber or similar material shall be affixed to the specimen contact surfaces of both clamps. This provides a cushion which minimizes thickness variation effects and also allows firm gripping of the specimen and minimizes slippage.

C-2.2 Adapter — An electromechanical (pneumatic) or similar suitable device for use in supporting and instantaneously releasing the dart so that it will fall freely on to the centre of test specimen in the specimen holder.

C-2.3 Dart — It consists of 3.81 cm diameter hemispherical head fitted with 0.64 cm diameter shaft 11.5 cm long, to accommodate removable mass. The head shall be constructed of aluminium, phenolic plastic or other low density material of similar hardness. The shaft shall be attached to the centre of the flat upper surface of the head with its longitudinal axis at 90° to the surface. The shaft shall be made of aluminium with a 1.27 cm long steel tip (tip with suitable material) at the end for supporting it in the adapter.

C-2.4 Masses — The stainless steel detachable masses are as follows:

One mass of 3 000 ± 5 g, two masses of 1 000 ± 5 g each, two masses of 500 ± 2 g each, two masses of 300 ± 2 g each, two masses of 200 ± 2 g each and two masses of 100 ± 2 g each having approximate dimensions of 8 to 10 cm in diameter and approximately 1 cm thickness with a hole in the centre of minimum 0.65 cm in diameter.

NOTE — Additional masses may be constructed for use, if it is necessary to extend mass beyond that attainable when using all the masses in the set suggested above.

C-2.5 Positioning Device — Means shall be provided for positioning the dart at the following drop heights from the impinging surface of the dart head to the surface of the test specimen:

Positioning	Drop Height mm
Normal impact resistant fabric	660
High impact resistant fabric	1 524

C-2.6 Cushioning and Shielding Devices — To protect personnel and to avoid damaging of the impinging surface of the dart.

C-3 TEST SPECIMENS

Test specimens shall be large enough to extend outside the specimen clamp gaskets at all points. The specimens shall be representative of the material under test and shall be free from pinholes, wrinkles, folds or other obvious imperfections, unless such imperfections constitute variables under test.

C-4 PROCEDURE

C-4.1 Place the specimen over the bottom portion of the clamp, making certain that it is uniformly flat, free of folds and that it covers the gasket at all points. Clamp the specimen in place by applying annular pressure with the top portion of the clamp. Position the dart vertically with the steel shaft tip inserted in the adapter and the impinging surface of the dart at the appropriate height from the fabric surface. Release the dart. Take care to avoid multiple impacts in cases where the dart bounces off the specimen. Attempt to catch the dart in such cases to prevent damage to the impinging surface.

C-4.2 Observe the failure as any break through the fabric readily by viewing the specimen under back lighting conditions and examine the specimen to determine whether it has failed or not. Use a new specimen for each impact.

C-4.3 Before beginning the test, make a few trial runs to establish approximately the working range of masses which will break the fabric. Then for at least 3 dart masses selected to give percentage failure between 20 and 80, a minimum of 10 test specimens at each dart mass shall be tested.

C-5 DETERMINATION OF IMPACT FAILURE LOAD

Plot the percentage of failures against total mass of the dart on a graph paper and determine the results graphically. Read the value of impact failure load from the graph as the dart mass at which 50 percent of the specimens fail.

ANNEX D

[*Table* 1, *Sl No.* (viii)]

DETERMINATION OF ASH CONTENT

D-1 PRINCIPLE

The procedure is used to find out the inorganic residue in sample by ashing it in a muffle furnace. A weighed amount of tape/fabric sample is heated to 590 °C. The polymer sample (organic portion) is burnt at 590 °C until constant mass of inorganic matter is obtained. The residue (inorganic matter) is reported in terms of percentage ash content in a given sample.

D-2 APPARATUS

D-2.1 Weighing Balance, accurate to 0.001 g.

D-2.2 Silica Crucibles, sufficient volume to accommodate 3 g of sample in such a way that level of the sample after filling the crucible does not cross half the height of crucible.

D-2.3 Bunsen Burner

D-2.4 Silica Triangle and Tripod

D-2.5 Muffle Furnace, capable of being controlled thermostatically at 590 ± 10 °C.

D-2.6 Desicator, containing an effective drying agent (for example, silica gel) that does not react chemically with ash components.

D-2.7 Gloves and Crucible Holder

D-3 SAFETY

D-3.1 Burn the sample in an effectively ventilated hood.

D-3.2 Keep the hood closed and do not inhale the fumes of combustion.

D-3.3 Wear gloves and use sample (crucible) holder, to introduce crucible in the furnace.

D-3.4 Sample shall be folded properly to accommodate it in silica crucible.

D-4 PROCEDURE

D-4.1 Heat the clean crucible at 590 ± 10 °C for 10 to 15 min and cool it in a desicator.

D-4.2 Weigh the empty crucible to nearest 0.001 g.

D-4.3 Weigh 3 g of sample in the crucible (nearest to 0.001 g).

D-4.4 Heat the crucible directly on burner so that the sample burns slowly and loss of ash is avoided. Continue burning until no more smoke is evolved.

D-4.5 Transfer the crucible in the muffle furnace, which is already maintained at approximately 590 °C and keep the crucible inside for about 2 h.

D-4.6 Remove the crucible from the furnace and cool it to the room temperature in a desicator. Weigh it and record the weight to accuracy of 0.001 g.

D-4.7 Keep the crucible in the muffle furnace for another half an hour, cool in a desicator and weigh again. Repeat the procedure until constant mass is obtained.

D-5 CALCULATION

$$\text{Percent ash content} = \frac{(\text{Weight of ash} \times 100)}{\text{Weight of sample}}$$

ANNEX E

[*Table* 1, *Sl No.* (xi)]

DETERMINATION OF THERMICITY IR EFFECTIVENESS

E-1 PRINCIPLE

The method consists of measuring the IR transmission spectrum of thermic fabric within wave numbers ranging from 1 430 cm^{-1} to 770 cm^{-1} (between 7 µm and 13 µm wavelengths).

This range of wavelengths corresponds to the field of maximum emission of the energy radiated by the earth's surface.

E-2 APPARATUS

E-2.1 Fourier Transform Infrared Spectroscope (FTIR) or Infrared spectrophotometer with a recorder.

E-2.2 Analytical balance with a 0.1 mg margin of error or planimeter.

E-3 PROCEDURE

The measurement shall be done on 5 specimens taken from the fabric under test. Put each specimen to be checked on the specimen holder of the spectrophotometer and record the spectrum of transmission from 1 430 cm^{-1} to 770 cm^{-1}. Measure the area between 100 percent transmittance and the curve of the spectrum with the help of a planimeter or by using the weighing method.

E-3.1 Weighing Method

Cut a sheet bearing the trace of the spectrum (or a copy of it) at 1 430 cm^{-1} and 770 cm^{-1} and along the lines of 0 percent and 100 percent transmittance. Weigh this rectangle to an accuracy of 0.1 mg. This mass shall be stated as P_{100}. Then cut along the outline of the spectrum and weigh the part representing the transmission. This second mass shall be stated as P_1.

E-4 SETTING OUT THE RESULTS

E-4.1 Planimeter Method

The percentage of the measured area of the spectrum in respect to the total area is the value of the IR effectiveness.

E-4.2 Weighing Method

The IR absorption in the range of wavelengths between 7 to 13 µm is given by the following formula:

$$IR_{\text{effectiveness}} = \left[\frac{P_{100} - P_1}{P_{100}}\right] \times 100$$

ANNEX F

(*Foreword*)

GUIDELINES FOR INSTALLATION, STORAGE AND HANDLING OF LAMINATED WOVEN ORCHARD PROTECTION COVERS

F-1 STORAGE

The laminated woven orchard protection covers shall be stored on a smooth surface in horizontal position in an enclosed shade, having air circulation and out of exposure to direct sunlight.

F-2 GUIDELINES FOR CANOPY STRUCTURE

F-2.1 Metal Structures — The metal tubes, angles, channels, wires shall be clean, polished, and preferably zinc galvanized, as higher concentration of iron (Fe) is detrimental to the life of the fabric and iron acts as a photo-oxidant and pro-degrading agent.

F-2.1.1 The angles and radius of the tubes shall be well designed to give uniform tension across the fabric. The typical structure as shown in Fig. 1 should give enough support so that there is no flapping of the fabric.

F-2.2 Wooden Framework — The wood shall be devoid of any sharp or protruding edges and shall have a smooth surface. Before selecting the type of wood, it shall be ensured that it does not secrete any substance, which is detrimental to life of the fabric. (For example, Pine wood shall be avoided)

F-2.3 Ensure that the framework is sturdy especially at the joints. If any components are loose or broken, they shall be rectified.

F-3 PREPARATION BEFORE INSTALLATION OF LAMINATED WOVEN ORCHARD PROTECTION COVERS

F-3.1 The covers need to be provided with laminated reinforcement band at edges, eyeleting and tied with flexible ropes on either side preferably by PP ropes.

F-3.2 All metal or wooden parts that are in contact with the fabric must be painted with a white acrylic-based paint/covered with plastic caps.

F-4 INSTALLATION OF LAMINATED WOVEN ORCHARD PROTECTION COVERS

F-4.1 While installing the laminated woven orchard protection covers, it shall be ensured that the respective layers are facing the right direction (that is, inside, or outside) as shown on fabric or instruction supplied along with the fabric.

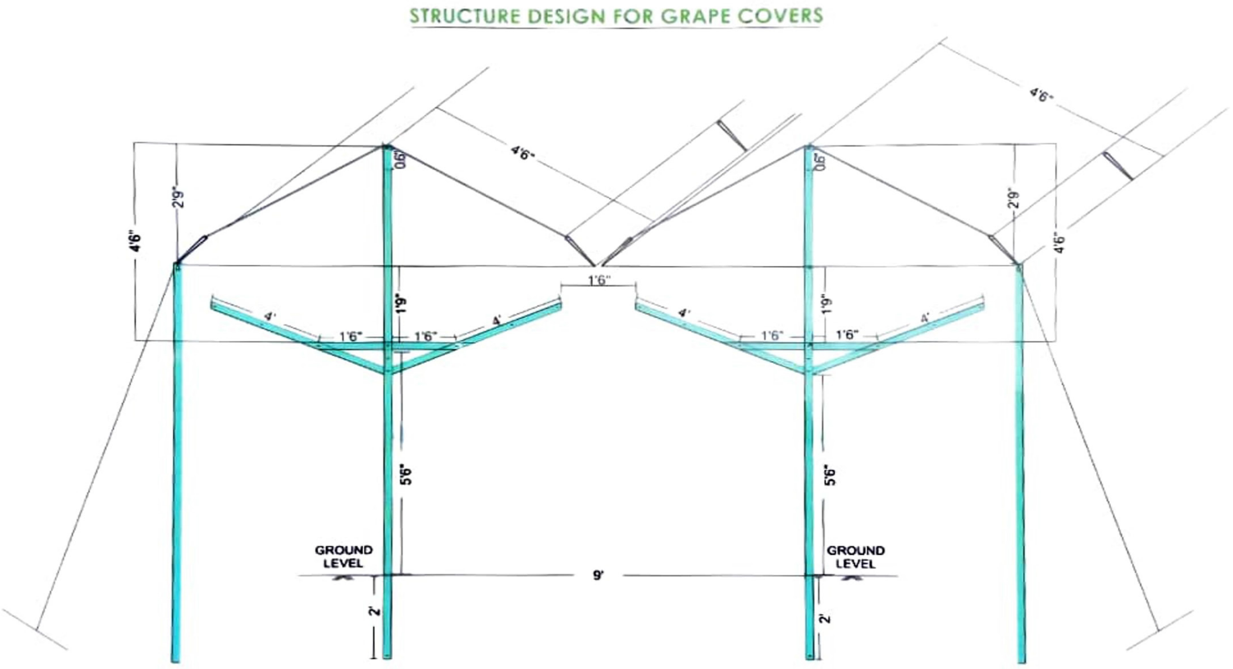

Fig. 1 Design for Typical Canopy Structure Used to Install Laminated Woven Orchard Protection Cover

F-4.2 It is advisable to keep a sample piece of 1 m^2 along with the manufacturer's identification mark.

F-4.3 Laminated woven orchard protection cover roll shall be placed out near the structure overnight. This process allows the plastic to acclimate to the outdoor temperature. The laminated woven orchard protection covers shall be installed in early hours of morning on mild days when the ambient temperature is cooler (15 to 23 ºC) and there is no wind. The plastic expands with the heat and contracts when cool, causing tears and damage to the fabric.

F-4.4 Plastics caps shall be fixed at every contact point wherever fabric comes in direct contact with angle/channel/wood/pipe of the frame/structure.

F-4.5 When positioning the fabric, it shall be tensioned tightly enough so that there is no flapping of fabric on windy days.

F-4.6 Proper care is be taken so that the fabric is not damaged or torn during installation. The ideal method is that the fabric shall be placed on the top of the canopy and unroll along the length of structure.

F-5 PROTECTION OF FABRIC

White acrylic-based paint shall be applied on the frame structure wherever it meets the fabric. If not, the fabric becomes warmer in the contact areas and is prone to faster degradation. Also, the metal contact fastens the oxidation process leading to early degradation. It shall be always checked that the iron (Fe) residues on the fabric do not exceed 50 ppm at any given time.

F-6 MAINTENANCE OF THE INSTALLED FABRIC

F-6.1 Any holes or tears must be repaired immediately with a special adhesive tape (non-PVC) designed for application in polyethylene fabrics.

F-6.2 Whenever required the fabric tied with flexible ropes, shall be re-stretched between the seasons or after strong winds to maintain the even tension of the fabric.

F-6.3 The typical photographic representation of installation of laminated woven orchard protection cover is given in Fig. 2 A, Fig 2 B and Fig. 2 C.

F-7 VENTILATION AND IRRIGATION

The orchard canopy must be suitably aerated and irrigated, especially in summer season. This is to prevent overheating of the orchard canopy and fabric. The area provided for ventilation shall be at least 20 percent of the ground surface.

F-8 CROP PROTECTION CHEMICALS

F-8.1 Crop protection chemicals based on sulphur, chlorine or halogens have a catalytic effect on the degradation process of fabric. Hence, any direct contact of crop protection chemicals with the fabric shall be avoided. However, to better ensure the stability, the following limitations with respect to the usage of chemicals should be adhered to.

Chemical Name	Spraying Limit, Max	Residual Limit, Max
Sulphur	2000 ppm	500 ppm
Chlorine	150 ppm	50 ppm
Iron	100	20 ppm

F-8.2 The use of crop protection products (herbicide, fungicides, insecticides, nematocides) can release chemical compounds that adversely affect the effectiveness of the stabilizers against UV radiation and base polymer effectiveness. It is important to follow certain recommendations:

a) comply with the dosages and frequencies of treatment recommended, limiting to the minimum use of pesticides, particularly those which have in their composition sulfur and/or chlorine;

b) perform the applications of pesticides on the crop and not on the fabric. Prevent accumulation of pesticides in the contact points of the structure with the fabric;

c) ventilate orchard as quickly, as possible;

d) cover the ground with plastic film that have barrier properties to prevent the attack of the disinfectant to the cover fabric, if the soil chemical disinfection is effectuated; and

e) ventilate the orchard when removing the film for disinfection.

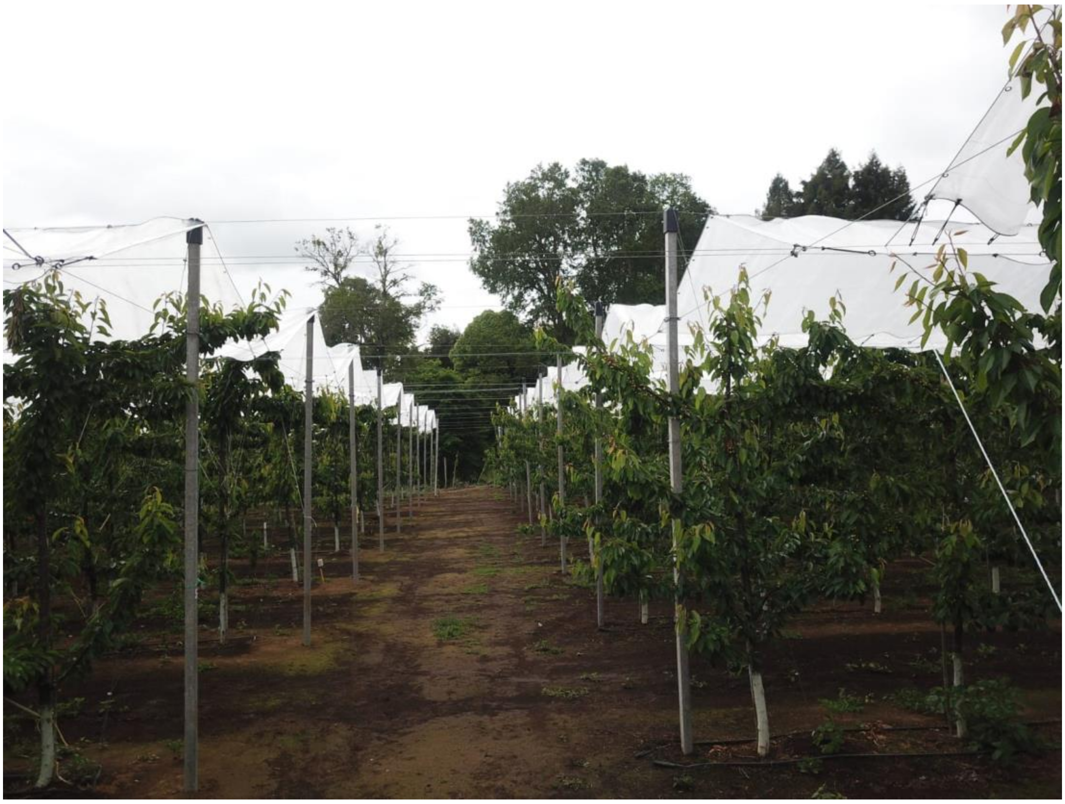

Fig. 2A

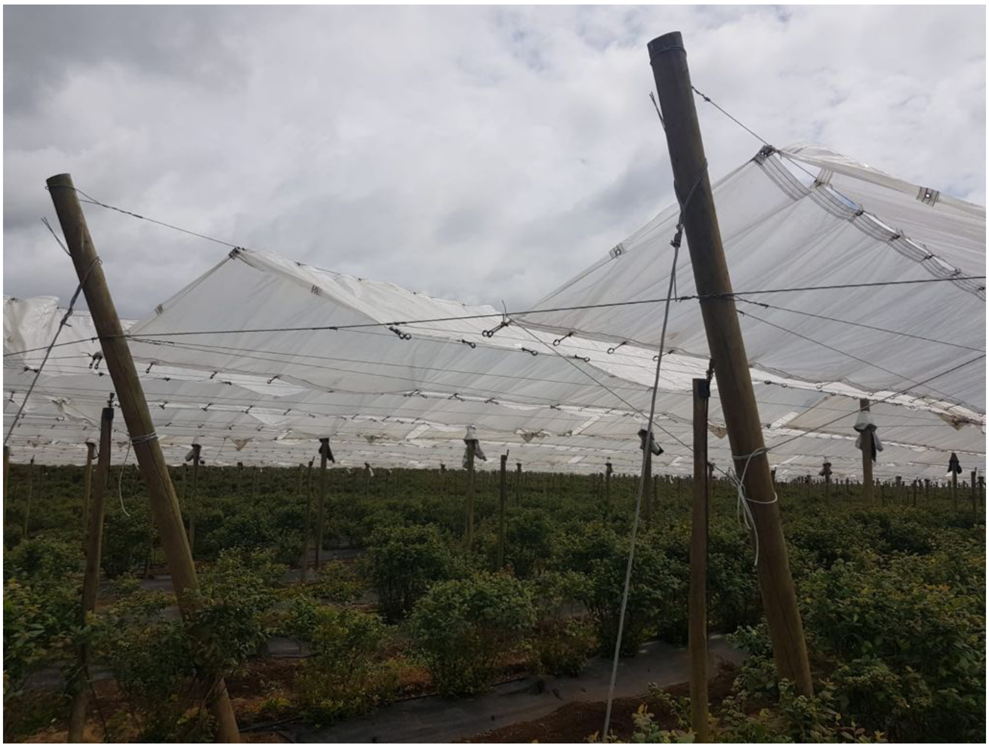

Fig. 2B

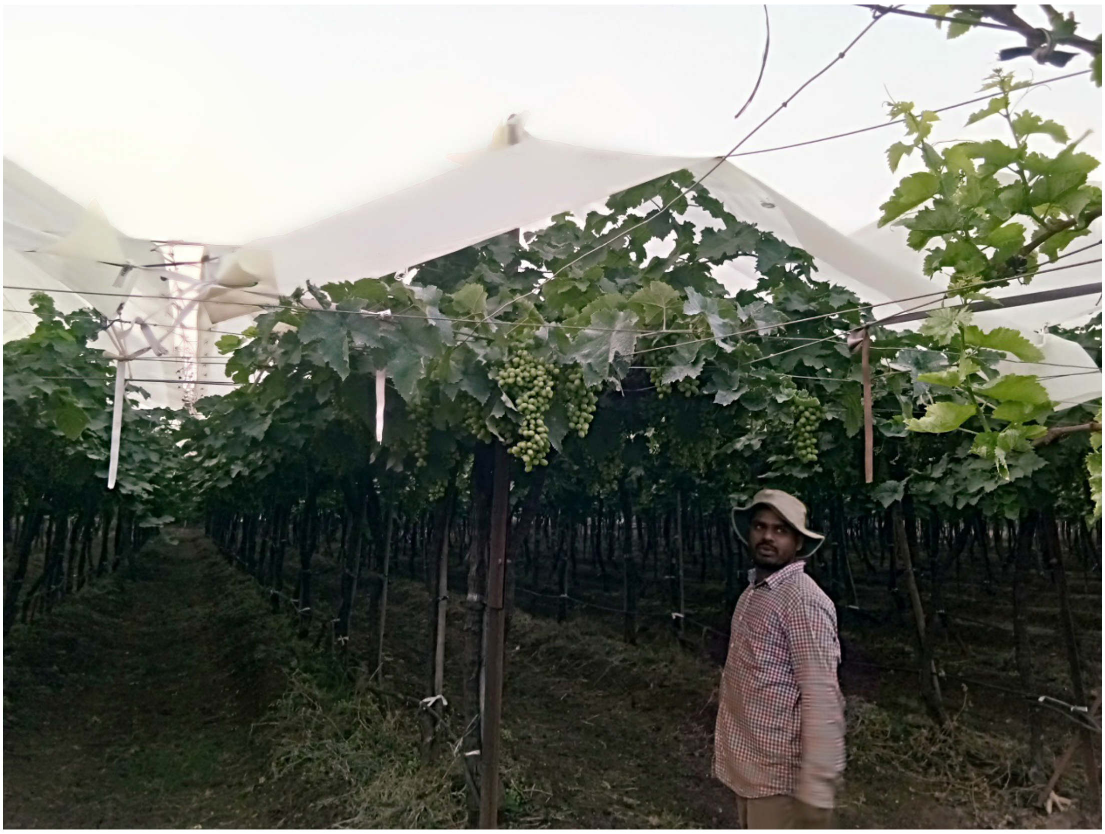

FIG. 2C

FIG. 2 TYPICAL PHOTOGRAPHIC REPRESENTATION OF LAMINATED WOVEN ORCHARD PROTECTION COVER INSTALLATIONS

ANNEX G

(*Foreword*)

COMMITTEE COMPOSITION

Technical Textiles for Agro-Tech Sectional Committee, TXD 35

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Central Institute for Research on Cotton Technology, Mumbai	Dr N. Vigneshwaran Dr P. K. Mandhyan (*Alternate*)
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Indian Jute Mills Association, Kolkata	Shri Samir Kumar Chandra Shri J. K. Behara (*Alternate*)
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Maharashtra State Horticulture and Medicinal Plant Board, Pune	Director Project Manager (PC & FP) (*Alternate*)

Organization	*Representative(s)*
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